

## Claims

- [c1] A process of removing acidic gases from a flue gas that contains sulfur dioxide without substantially decreasing the amount of sulfur dioxide in the flue gas, the process comprising the steps of:
- preparing an aqueous solution containing at least one reaction compound selected from the group consisting of sodium carbonate, sodium bicarbonate, sodium hydroxide, ammonium hydroxide, potassium hydroxide, potassium carbonate, and potassium bicarbonate; and
- contacting a flue gas with the aqueous solution in the form of a spray whose droplet size and solution concentration enable the aqueous solution to dry on contact with the flue gas and then react with an acidic gas in the flue gas to remove the acidic gas without decreasing the amount of sulfur dioxide in the flue gas.
- [c2] A process according to claim 1, wherein the acidic gas is at least one of sulfur trioxide, sulfuric acid vapors and hydrochloric acid vapors.
- [c3] A process according to claim 1, wherein the aqueous solution further contains at least one of sodium sulfite, sodium bisulfite, potassium sulfite and potassium bisulfite.
- [c4] A process according to claim 1, wherein the droplet size of the aqueous solution when contacting the flue gas is not larger than about 100 micrometers.
- [c5] A process according to claim 1, wherein the reaction compound is present in the aqueous solution at a concentration of less than 15 molar percent of the amount of sulfur dioxide in the flue gas.
- [c6] A process according to claim 1, wherein the reaction compound is present in the aqueous solution at a concentration of less than 10 molar percent of the amount of sulfur dioxide in the flue gas.
- [c7] A process according to claim 1, wherein the reaction compound consists of sodium carbonate and sodium bicarbonate, and optionally one or more of sodium hydroxide, ammonium hydroxide, potassium hydroxide, potassium carbonate, potassium bicarbonate, potassium sulfite, potassium bisulfite,

sodium sulfite and sodium bisulfite.

- [c8] A process according to claim 1, wherein the reaction compound consists of sodium carbonate and sodium bicarbonate.
- [c9] A process according to claim 1, further comprising the step of flowing the flue gas through an air preheater immediately downstream from where the flue gas is contacted with the aqueous solution.
- [c10] A process of removing acidic gases from a flue gas that contains sulfur dioxide without substantially decreasing the amount of sulfur dioxide in the flue gas, the process comprising the steps of:  
preparing an aqueous solution containing at least one reaction compound selected from the group consisting of sodium carbonate, sodium bicarbonate, sodium hydroxide, ammonium hydroxide, potassium hydroxide, potassium carbonate, and potassium bicarbonate, the reaction compound being present in the aqueous solution at a concentration of less than 15 molar percent of the amount of sulfur dioxide in the flue gas;  
contacting a flue gas with the aqueous solution in the form of a spray having a droplet size of not larger than about 100 micrometers so that the aqueous solution dries on contact with the flue gas to form particles of the reaction compound; and  
reacting the particles of the reaction compound with an acidic gas in the flue gas to remove the acidic gas, wherein any sulfur dioxide reacted by the reaction compound is substantially reformed so that the amount of sulfur dioxide in the flue gas is not substantially decreased.
- [c11] A process according to claim 10, wherein the acidic gas is at least one of sulfur trioxide and sulfuric acid vapors.
- [c12] A process according to claim 10, wherein the reaction compound consists of sodium carbonate and sodium bicarbonate, and optionally one or more of sodium hydroxide, ammonium hydroxide, potassium hydroxide, potassium carbonate, potassium bicarbonate, potassium sulfite, potassium bisulfite, sodium sulfite and sodium bisulfite.

- [c13] A process according to claim 12, wherein the reaction compound is present in the aqueous solution at a concentration of less than 10 molar percent of the amount of sulfur dioxide in the flue gas.
- [c14] A process according to claim 10, wherein the aqueous solution further contains at least one of sodium sulfite, sodium bisulfite, potassium sulfite and potassium bisulfite.
- [c15] A process according to claim 14, wherein the reaction compound is present in the aqueous solution at a concentration of less than 10 molar percent of the amount of sulfur dioxide in the flue gas.
- [c16] A process according to claim 10, wherein the reaction compound consists of sodium carbonate and sodium bicarbonate, and is present in the aqueous solution at a concentration of less than 10 molar percent of the amount of sulfur dioxide in the flue gas.
- [c17] A process according to claim 10, wherein the reaction compound consists of one or more of sodium hydroxide, ammonium hydroxide, potassium hydroxide, potassium carbonate, and potassium bicarbonate.
- [c18] A process according to claim 17, wherein the reaction compound is present in the aqueous solution at a concentration of less than 10 molar percent of the amount of sulfur dioxide in the flue gas.
- [c19] A process according to claim 10, wherein the reaction compound is present in the aqueous solution at a concentration of less than 10 molar percent of the amount of sulfur dioxide in the flue gas.
- [c20] A process according to claim 10, further comprising the step of flowing the flue gas through an air preheater immediately downstream from where the flue gas is contacted with the aqueous solution.